

AMENDMENTS TO THE CLAIMS:

Claims 1-31 (cancelled)

32. (New) A component recognizing method comprising:

while transversely moving a plurality of component holding members relative to a recognition unit, with said plurality of component holding members holding a plurality of components such that surfaces of said plurality of components are at different levels,

(i) for each surface of said plurality of components that does not correspond to a recognizable range of said recognition unit, vertically moving a corresponding one of said plurality of component holding members so as to adjust the level of this surface such that this surface is brought within said recognizable range, and

(ii) when each surface of said plurality of components comes within said recognizable range, using said recognition unit to recognize this surface,

thereby continuously recognizing said surfaces of said plurality of components.

33. (New) The component recognizing method according to claim 32, wherein when bottom end surfaces of said plurality of component holding members are at identical levels said surfaces of said plurality of components are incapable of all being within said recognizable range simultaneously, said method further comprising:

acquiring information on groups of said plurality of component holding members that hold respective ones of said plurality of components having surfaces which are capable of being received within said recognizable range simultaneously,

wherein transversely moving said plurality of component holding members relative to said recognition unit comprises

(i) moving said plurality of component holding members in a first direction over said recognition unit such that a corresponding surface of each of said plurality of components held by said component holding members of one of said groups is within said recognizable range without first vertically moving a corresponding one of said plurality of component holding members, and

(ii) moving said plurality of component holding members in a second direction, opposite to said first direction, over said recognition unit such that a corresponding surface of each of said plurality of components held by said component holding members of a second of said groups is within said recognizable range after first vertically moving of a corresponding one of said plurality of component holding members.

34. (New) A component recognizing method comprising:

acquiring information of a first group and a second group of component holding members, wherein each component holding member of said first group holds a component such that a surface of this component is within a recognizable range of a recognition unit when a bottom end surface of said each component holding member of said first group is at a first level, and wherein each component holding member of said second group holds a component such that a surface of this component is not within said recognizable range of said recognition unit when a bottom end surface of said each component holding member of said second group is at said first level;

while moving said each component holding member of said first group and said second group in a first direction over said recognition unit such that said bottom end surface of said each component holding member of said first group is at said first level, recognizing said surface of each component held by said each component holding member of said first group; and then

after vertically moving said each component holding member of said second group such that said surface of each component held by said component holding member of said second group comes within said recognizable range of said recognition unit, and while moving said each component holding member of first group and said second group in a second direction, opposite to said first direction, over said recognition unit, recognizing said surface of said each component held by said each component holding member of said second group.

35. (New) The component recognizing method according to claim 34, wherein

recognizing said surface of each component held by said each component holding member of said first group includes recognizing a shape of said each component held by said each component holding member of said first group, and

recognizing said surface of each component held by said each component holding member of said second group includes recognizing a shape of said each component held by said each component holding member of said second group.

36. (New) A component recognizing apparatus comprising:

a recognition unit;

a plurality of transversely movable component holding members; and

a drive unit for vertically moving said plurality of component holding members,

said recognition unit, said plurality of component holding members and said drive unit being constructed and arranged such that while said plurality of component holding members are transversely moved relative to said recognition unit, with said plurality of component holding members holding a plurality of components such that surfaces of said plurality of components are at different levels,

(i) for each surface of the plurality of components that does not correspond to a recognizable range of said recognition unit, a corresponding one of said plurality of component holding members is vertically moved by said drive unit so as to adjust the level of this surface such that this surface is brought within the recognizable range, and

(ii) when each surface of the plurality of components comes within the recognizable range, said recognition unit is used to recognize this surface,

so as to continuously recognize the surfaces of the plurality of components.

37. (New) The component recognizing apparatus according to claim 36, wherein when bottom end surfaces of said plurality of component holding members are at identical levels the surfaces of the plurality of components are incapable of all being within the recognizable range simultaneously, said apparatus further comprising:

structure for acquiring information on groups of said plurality of component holding members that hold respective ones of the plurality of components having surfaces which are capable of being received within the recognizable range simultaneously,

wherein said recognition unit, said plurality of component holding members and said drive unit are constructed and arranged such that transversely moving said plurality of component holding members relative to said recognition unit comprises

(i) moving said plurality of component holding members in a first direction over said recognition unit such that a corresponding surface of each of the plurality of components held by said holding members of one of said groups is within the recognizable range without first vertically moving a corresponding one of said plurality of component holding members, and

(ii) moving said plurality of component holding members in a second direction, opposite to said first direction, over said recognition unit such that a corresponding surface of each of the plurality of components held by said holding members of a second of said groups is within the recognizable range after first using said drive unit to vertically move a corresponding one of said plurality of component holding members.

38. (New) A component recognizing apparatus comprising:
a first group and a second group of component holding members;
a drive unit to vertically move said first group and said second group of said component holding members;

a recognition unit; and
structure for acquiring information of said first group and said second group of said component holding members, wherein each component holding member of said first group is to hold a component such that a surface of this component is within a recognizable range of said recognition unit when a bottom end surface of said each component holding member of said first group is at a first level, and wherein each component holding member of said second group is to hold a component such that a surface of this component is not within the recognizable range of said recognition unit when a bottom end surface of said each component holding member of said second group is at the first level,

wherein said first and second groups of component holding members, said drive unit and said recognition unit are constructed and arranged such that

(i) while moving said each component holding member of said first group and said second group in a first direction over said recognition unit such that said bottom end surface of said each component holding member of said first group is at the first level, the surface of each component held by said each component holding member of said first group is recognized by said recognition unit, and then

(ii) after using said drive unit to vertically move said each component holding member of said second group such that the surface of each component held by said each component holding member of said second group is within the recognizable range of said recognition unit, and while moving said each component holding member of said first group and said second group in a second direction, opposite to the first direction, over said recognition unit, the surface of each component held by said each component holding member of said second group is recognized by said recognition unit.

39. (New) The component recognizing apparatus according to claim 38, wherein said recognition unit is constructed and arranged such that

recognizing the surface of each component held by said each component holding member of said first group, by said recognition unit, includes recognizing a shape of each component held by said each component holding member of said first group, and

recognizing the surface of each component held by said each component holding member of said second group, by said recognition unit, includes recognizing a shape of each component held by said each component holding member of said second group.

40. (New) A component mounting apparatus comprising:
a recognition unit;
a plurality of transversely movable component holding members;
a drive unit for vertically moving said plurality of component holding members; and
a head unit including said plurality of component holding members and said drive unit,
said recognition unit, said plurality of component holding members, said drive unit and said head unit being constructed and arranged such that while said plurality of component holding

members are transversely moved relative to said recognition unit, with said plurality of component holding members holding a plurality of components such that surfaces of the plurality of components are at different levels,

(i) for each surface of the plurality of components that does not correspond to a recognizable range of said recognition unit, a corresponding one of said plurality of component holding members is vertically moved by said drive unit so as to adjust the level of this surface such that this surface is brought within the recognizable range, and

(ii) when each surface of the plurality of components comes within the recognizable range, said recognition unit is used to recognize this surface,

so as to continuously recognize the surfaces of the plurality of components.

41. (New) The component mounting apparatus according to claim 40, wherein when bottom end surfaces of said plurality of component holding members are at identical levels the surfaces of the plurality of components are incapable of all being within the recognizable range simultaneously, said apparatus further comprising:

structure for acquiring information on groups of said plurality of component holding members that hold respective ones of the plurality of components having surfaces which are capable of being received within the recognizable range simultaneously,

wherein said recognition unit, said plurality of component holding members, said drive unit and said head unit are constructed and arranged such that transversely moving said plurality of component holding members relative to said recognition unit comprises

(i) moving said plurality of component holding members in a first direction over said recognition unit such that a corresponding surface of each of the plurality of components held by said component holding members of one of said groups is within the recognizable range without first vertically moving a corresponding one of said plurality of component holding members, and

(ii) moving said plurality of component holding members in a second direction, opposite to said first direction, over said recognition unit such that a corresponding surface of each of the plurality of components held by said component holding members of a second of said groups

is within the recognizable range after first using said drive unit to vertically move a corresponding one of said plurality of component holding members.

42. (New) A component mounting apparatus comprising:
- a first group and a second group of component holding members;
 - a drive unit to vertically move said first group and said second group of component holding members;
 - a recognition unit;
 - a head unit including said plurality of component holding members and said drive unit; and
 - structure for acquiring information on said first group and said second group of component holding members, wherein each component holding member of said first group is to hold a component such that a surface of this component is within a recognizable range of said recognition unit when a bottom end surface of said each component holding member of said first group is at a first level, and wherein each component holding member of said second group is to hold a component such that a surface of this component is not within the recognizable range of said recognition unit when a bottom end surface of said each component holding member of said second group is at the first level,
- wherein said first and second groups of component holding members, said drive unit, said recognition unit and said head unit are constructed and arranged such that
- (i) while moving said each component holding member of said first group in a first direction over said recognition unit such that said bottom end surface of said each component holding member of said first group is at the first level, the surface of each component held by said each component holding member of said first group is recognized by said recognition unit, and then
 - (ii) after using said drive unit to vertically move said each component holding member of said second group such that the surface of each component held by said each component holding member of said second group is within the recognizable range of said recognition unit, and while moving said each component holding member of said second group in a second direction, opposite to the first direction, over said recognition unit, the surface of each component held by said each component holding member of said second group is recognized by said recognition unit.

43. (New) The component mounting apparatus according to claim 42, wherein said recognition unit is constructed and arranged such that

recognizing the surface of each component held by said each component holding member of said first group, by said recognition unit, includes recognizing a shape of each component held by said each component holding member of said first group, and

recognizing the surface of each component held by said each component holding member of said second group, by said recognition unit, includes recognizing a shape of each component held by said each component holding member of said second group.

44. (New) The component mounting apparatus according to claim 42, further comprising:
a table adapted to be moved vertically by said drive unit; and
cylinders fixed to said table, said cylinders corresponding to said component holding members, wherein each of said cylinders is adapted to bring a tip of a piston into contact with a selected corresponding one of said component holding members so as to vertically move the selected corresponding one of said component holding members, from among the other of said component holding members, and thereby transmit vertical movement of said table to the selected corresponding one of said component holding members.

45. (New) The component recognizing method according to claim 32, further comprising:
producing a velocity curve, for vertical movement of a selected one of said plurality of component holding members, with parameters of

(i) a target position in a height direction at a time when vertical movement of said selected one of said plurality of component holding members is to be controlled so as to position the surface of the component held by said selected one of said plurality of component holding members within said recognizable range,

(ii) a maximum velocity of said selected one of said plurality of component holding members during vertical movement thereof to said target position, and

(iii) a maximum acceleration of said selected one of said plurality of component holding members during vertical movement thereof to said target position; and

on a basis of said velocity curve, and in response to a starting instruction upon arrival of said selected one of said plurality of component holding members at a starting position due to said selected one of said plurality of component holding members moving transversely toward said recognition unit, automatically starting vertical movement of said selected one of said plurality of component holding members so as to position said surface of said component held by said selected one of said plurality of component holding members within said recognizable range.

46. (New) The component recognizing method according to claim 45, further comprising: producing a velocity curve, for vertical movement of each other of said plurality of component holding members, with parameters of

(i) a target position in a height direction at a time when vertical movement of said each other of said plurality of component holding members is to be controlled so as to position the surface of the component held by said each other of said plurality of component holding members within said recognizable range,

(ii) a maximum velocity of said each other of said plurality of component holding members during vertical movement thereof to said target position, and

(iii) a maximum acceleration of said each other of said plurality of component holding members during vertical movement thereof to said target position; and

on a basis of said velocity curve for said each other of said plurality of component holding members, and in response to a starting instruction upon arrival of said each other of said plurality of component holding members at a starting position due to said each other of said plurality of component holding members moving transversely toward said recognition unit, automatically starting vertical movement of said each other of said plurality of component holding members, at different times, so as to position said surface of said component held by said each other of said plurality of component holding members within said recognizable range.

47. (New) The component recognizing method according to claim 46, further comprising: judging whether ending positions, corresponding to the starting positions for said selected one and said each other of said plurality of component holding members, have been reached so as to

determine whether said surfaces of said components held by said selected one and said each other of said plurality of component holding members have been received within said recognizable range.

48. (New) The component recognizing apparatus according to claim 36, further comprising:

a first control unit for producing a velocity curve, for vertical movement of a selected one of said plurality of component holding members, with parameters of

(i) a target position in a height direction at a time when vertical movement of said selected one of said plurality of component holding members is to be controlled so as to position the surface of the component held by said selected one of said plurality of component holding members within the recognizable range,

(ii) a maximum velocity of said selected one of said plurality of component holding members during vertical movement thereof to the target position, and

(iii) a maximum acceleration of said selected one of said plurality of component holding members during vertical movement thereof to the target position; and

a second control unit for, on a basis of the velocity curve, and in response to a starting instruction upon arrival of said selected one of said plurality of component holding members at a starting position due to said selected one of said plurality of component holding members moving transversely toward said recognition unit, automatically starting vertical movement of said selected one of said plurality of component holding members so as to position the surface of the component held by said selected one of said plurality of component holding members within the recognizable range.

49. (New) The component recognizing apparatus according to claim 48, wherein said first control unit is also for producing a velocity curve, for vertical movement of each other of said plurality of component holding members, with parameters of

(i) a target position in a height direction at a time when vertical movement of said each other of said plurality of component holding members is to be controlled so as to position the surface

of the component held by said each other of said plurality of component holding members within the recognizable range,

(ii) a maximum velocity of said each other of said plurality of component holding members during vertical movement thereof to the target position, and

(iii) a maximum acceleration of said each other of said plurality of component holding members during vertical movement thereof to the target position, and

said second control unit is also for, on a basis of the velocity curve for said each other of said plurality of component holding members, and in response to a starting instruction upon arrival of said each other of said plurality of component holding members at a starting position due to said each other of said plurality of component holding members moving transversely toward said recognition unit, automatically starting vertical movement of said each other of said plurality of component holding members, at different times, so as to position the surface of the component held by said each other of said plurality of component holding members within the recognizable range.

50. (New) The component recognizing apparatus according to claim 49, wherein said second control unit is also for judging whether ending positions, corresponding to the starting positions for said selected one and said each other of said plurality of component holding members, have been reached so as to determine whether the surfaces of the components held by said selected one and said each other of said plurality of component holding members have been received within the recognizable range.

51. (New) The component mounting apparatus according to claim 40, further comprising: a table in screw engagement with a ball screw, with said drive unit including a motor that is adapted to rotate said ball screw so as to vertically move said table;

cylinders fixed to said table, said cylinders corresponding to said component holding members and being adapted to bring a tip of a piston into contact with a selected corresponding one of said component holding members so as to vertically move the selected corresponding one of said component holding members, from among the other of said component holding members, and thereby

transmit vertical movement of said table to the selected corresponding one of said component holding members;

a first control unit for producing a velocity curve, for vertical movement of selected ones of said plurality of component holding members, with parameters of

(i) a target position in a height direction at a time when vertical movement of said selected ones of said plurality of component holding members is to be controlled by said motor so as to position the surfaces of the components held by said selected ones of said plurality of component holding members within the recognizable range,

(ii) a maximum velocity of said selected ones of said plurality of component holding members during vertical movement thereof to the target position, and

(iii) a maximum acceleration of said selected ones of said plurality of component holding members during vertical movement thereof to the target position; and

a second control unit for, on a basis of the velocity curve, and in response to a starting instruction upon arrival of said selected ones of said plurality of component holding members at a starting position due to said selected ones of said plurality of component holding members moving transversely toward said recognition unit, driving said motor so as to automatically start vertical movement of said selected ones of said plurality of component holding members so as to position the surfaces of the components held by said selected ones of said plurality of component holding members within said recognizable range.

52. (New) The component mounting apparatus according to claim 51, further comprising:

a transverse movement motor for moving said plurality of component holding members in a transverse direction,

wherein said first control unit is also for producing a velocity curve, for transverse movement of said selected ones of said plurality of component holding members via said transverse movement motor, with parameters of

(i) a target position in the transverse direction at a time when transverse movement of said selected ones of said plurality of component holding members to vertical drive starting positions for said selected ones of said plurality of component holding members is to be controlled

by said transverse movement motor so as to prepare to position the surfaces of the components held by said respective ones of said plurality of component holding members within the recognizable range,

(ii) a maximum velocity of said selected ones of said plurality of component holding members during transverse movement thereof to the target position, and

(iii) a maximum acceleration of said selected ones of said plurality of component holding members during transverse movement thereof to the target position; and

wherein said second control unit is also for, on a basis of the velocity curve for transverse movement and in response to a starting instruction, driving said transverse movement motor so as to move said selected ones of said plurality of component holding members to the starting position due to said selected ones of said plurality of component holding members moving with said head unit transversely toward said recognition unit.

53. (New) A component mounting method comprising:

while transversely moving a plurality of component holding members relative to a recognition unit, with said plurality of component holding members holding a plurality of components such that surfaces of said plurality of components are at different levels,

(i) for each surface of said plurality of components that does not correspond to a recognizable range of said recognition unit, vertically moving a corresponding one of said plurality of component holding members so as to adjust the level of this surface such that this surface is brought within said recognizable range, and

(ii) when each surface of said plurality of components comes within said recognizable range, using said recognition unit to recognize this surface,

thereby continuously recognizing said surfaces of said plurality of components;

correcting postures of said components, as necessary, based upon the recognized surfaces of said plurality of components; and then

mounting said plurality of components onto an object.

54. (New) A component mounting apparatus comprising:
a recognition unit;
a plurality of transversely movable component holding members; and
a drive unit for vertically moving said plurality of component holding members,
said recognition unit, said plurality of component holding members and said drive unit being
constructed and arranged such that while said plurality of component holding members are
transversely moved relative to said recognition unit, with said plurality of component holding
members holding a plurality of components such that surfaces of said plurality of components are at
different levels,

(i) for each surface of the plurality of components that does not correspond to a
recognizable range of said recognition unit, a corresponding one of said plurality of component
holding members is vertically moved by said drive unit so as to adjust the level of this surface such
that this surface is brought within the recognizable range, and

(ii) when each surface of the plurality of components comes within the recognizable
range, said recognition unit is used to recognize this surface,

so as to continuously recognize the surfaces of the plurality of components;
structure to correct postures of the plurality of components, as necessary, based upon the
recognized surfaces of the plurality of components; and
structure to mount the plurality of components onto an object.

55. (New) The component recognizing method according to claim 34, further
comprising:

imaging each component held by said each component holding member of said first group and
each component held by said each component holding member of said second group during
movement thereof in said first direction and said second direction.

56. (New) A component recognizing method comprising:
acquiring information of a first group and a second group of component holding members,
wherein each component holding member of said first group holds a component such that a surface

of this component is within a recognizable range of a recognition unit when a bottom end surface of said each component holding member of said first group is at a first level, and wherein each component holding member of said second group holds a component such that a surface of this component is not within said recognizable range of said recognition unit when a bottom end surface of said each component holding member of said second group is at said first level;

while moving said each component holding member of said first group and said second group in a first direction over said recognition unit such that said bottom end surface of said each component holding member of said first group is at said first level, recognizing said surface of each component held by said each component holding member of said first group; and then

while moving said each component holding member of first group and said second group over another recognition unit such that a surface of this component is within a recognizable range of said another recognition unit, recognizing said surface of said each component held by said each component holding member of said second group.

57. (New) The component recognizing method according to claim 56, further comprising:
adjusting the level of said each component holding member of said second group prior to moving said each component holding member of said first group and said second group over said another recognition unit.

58. (New) The component recognizing apparatus according to claim 38, wherein a control unit is provided for

(i) while moving said each component holding member of said first group and said second group in a first direction over said recognition unit such that said bottom end surface of said each component holding member of said first group is at the first level, recognizing the surface of each component held by said each component holding member of said first group by said recognition unit, and then

(ii) after using said drive unit to vertically move said each component holding member of said second group such that the surface of each component held by said each component holding member of said second group is within the recognizable range of said recognition unit, and while

moving said each component holding member of said first group and said second group in a second direction, opposite to the first direction, over said recognition unit, recognizing the surface of each component held by said each component holding member of said second group by said recognition unit,

with said control unit also being for imaging each component held by said each component holding member of said first group and each component held by said each component holding member of said second group during movement thereof in said first direction and said second direction.

59. (New) A component recognizing apparatus comprising:

a first group and a second group of component holding members;

a drive unit to vertically move said first group and said second group of component holding members;

a first recognition unit;

a second recognition unit;

structure for acquiring information of said first group and said second group of component holding members, wherein each component holding member of said first group is to hold a component such that a surface of this component is within a recognizable range of said first recognition unit when a bottom end surface of said each component holding member of said first group is at a first level, and wherein each component holding member of said second group is to hold a component such that a surface of this component is not within the recognizable range of said first recognition unit when a bottom end surface of said each component holding member of said second group is at the first level; and

a control unit for

(i) while moving said each component holding member of said first group and said second group in a first direction over said first recognition unit such that said bottom end surface of said each component holding member of said first group is at the first level, recognizing the surface of each component held by said each component holding member of said first group by said first recognition unit, and then

(ii) while moving said each component holding member of said first group and said second group over said second recognition unit such that a surface of this component is within a recognizable range of said second recognition unit, recognizing the surface of each component held by said component holding member of said second group.

60. (New) The component recognizing apparatus according to claim 59, wherein said control unit is also for adjusting the level of said each component holding member of said second group prior to moving said each component holding member of said first group and said second group over said second recognition unit.

61. (New) The component mounting apparatus according to claim 43, further comprising:
a table adapted to be moved vertically by said drive unit; and
cylinders fixed to said table, said cylinders corresponding to said component holding members, wherein each of said cylinders is adapted to bring a tip of a piston into contact with a selected corresponding one of said component holding members so as to vertically move the selected corresponding one of said component holding members, from among the other of said component holding members, and thereby transmit vertical movement of said table to the selected corresponding one of said component holding members.